

TIER 1

NEW
AREA
PERM

**UNDERGROUND INJECTION CONTROL
PERMIT APPLICATION**

Ute Tribal # 36-08-E4
1796' FNL & 713' FEL
Sec. 36, T5S-R4W
Duchesne County, Utah
API # 43-013-31815

July 2015

Prepared for:
Bruce Suchomel
Groundwater Program, Mail Code 8P-W-UIC
U.S. Environmental Protection Agency
1595 Wynkoop St
Denver, CO 80202-1129

Prepared by:
Petroglyph Energy, INC.
960 Broadway Avenue, Suite 500, P.O. Box 70019
Boise, Idaho 83707
(208) 685-7600
FAX (208) 685-7605

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- USDW SOURCE
- SUPPLY REPORTS
- AOR CBL.

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LIST OF ATTACHMENTS

Attachment No. 1	Area Topography Map
Attachment No. 2	Site Map
Attachment No. 3	Map of the A-Marker surface
Attachment No. 4	Cross-Sections of the injection formation
Attachment No. 5	Water Analysis
Attachment No. 6	Completion data for all wells in the AOR
Attachment No. 7	CBL for the UIC well
Attachment No. 8	Open hole log for the UIC well
Attachment No. 9	List of owners and Affidavit Notification
Attachment No. 10	Well bore diagrams for the UIC well
Attachment No. 11	P&A procedure
Attachment No. 12	MIT procedure
Attachment No. 13	Surety Bond letter



July 29th, 2015

Dear Mr. Suchomel,

Petroglyph would like to request a minor modification of Area Permit #UT20736-0000, expanding the permitted area to cover an additional 160 acres in the E½E½ Section 36, T5S- R4W, USM, shown as an orange rectangle on the attached map.

Petroglyph has previously been granted a minor modification from the EPA to include sections 33 & 34, T4S- R3W, USM in our area permit, shown as an orange-outlined area on the attached map.

Petroglyph has no records of the 1998 modification; therefore, we do not know the procedure for adding additional areas.

We have identified offset surface owners, mineral owners, and oil and gas operators that would be affected within one quarter-mile of the proposed area permit expansion, also shown on the attached map.

Surface owners: Ute Tribe and the Federal government (under the administration of USFS)

Mineral owners: Ute Tribe and the Federal government (under the administration of USFS)

Oil and Gas operators: Petroglyph Energy, Linn Operating, INC., and Vantage Energy

Petroglyph requests guidance on how to proceed with obtaining the requested modification, specifically what we would need to provide to the EPA and affected third parties.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jessica Graham'.

Jessica Graham

Geologist

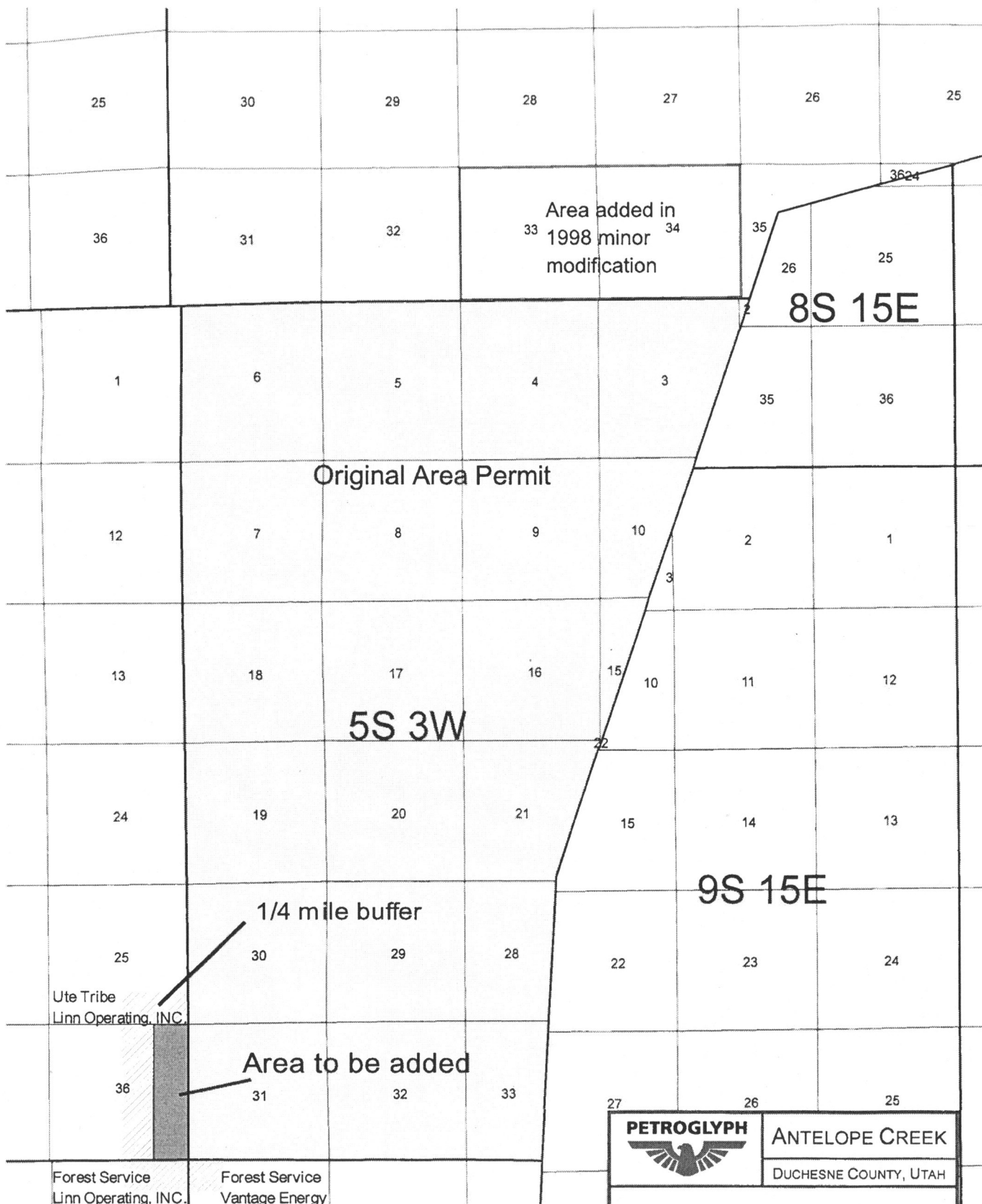
Petroglyph Energy

jgraham@pgei.com

208-685-7631

Enclosure

PETROGLYPH OPERATING COMPANY, INC.



**SUMMARY DOCUMENT
UIC WELL APPLICATION
Ute Tribal 36-08-E4
API # 43-013-31815**

The following document contains information provided in support of the application for the conversion of the Ute Tribal 36-08-E4 well to an injection well in the Green River formation in the Antelope Creek Field in Duchesne County, Utah.

The Antelope Creek Field falls within the Uintah and Ouray Indian reservations and is within Indian Country; therefore, for facilities located on the reservation, only EPA-issued UIC permits are necessary for compliance with UIC regulations.

The EPA has issued an Area Permit #UT20736-00000 for the Underground Injection Control for the Antelope Creek Field. This area permit allows for additional producing wells to be converted to injection wells for enhanced recovery.

- (1) Petroglyph Energy, Inc. (Petroglyph) is the operator and only working interest owner of wells located in the Antelope creek Field, Duchesne County, Utah. Petroglyph's business address is provided below:

Petroglyph Energy, Inc.
960 Broadway Avenue, Suite 500
P.O. Box 70019
Boise, ID 83707

- (2) Enclosed as Attachment No. 1 is a topographic map of a portion of the Antelope Creek Field, identifying all wells located in this area. The legal location for the Ute Tribal 36-08-E4 is 1796' FNL & 713' FEL SE/NE Sec. 36, T5S-R4W.
- (3) Attachment No. 2 is a map of the well. This map shows a circle with a ¼ mile radius centered on the Ute Tribal 36-08-E4 well. The ¼ mile radius encompasses the area of review, AOR, within which Petroglyph is required to investigate all wells for mechanical integrity. The ¼ mile radius also identifies mineral ownership; all lands within the AOR are leased to Petroglyph by the Ute Tribe as indicated by yellow shading. The AOR has no other well(s) located in its ¼ mile radius.

- (4) Petroglyph proposes to utilize the Ute Tribal 36-08-E4 as an injection well for enhanced recovery in the Antelope Creek Field.
- (5) Injection Zone – The injection intervals are between 3534' and 5499' True Vertical Depth and located in the lower portion of the Green River Formation. The injection zone is confined within a 1965' section between the Green River "A" Lime marker bed and the top of the Basal Carbonate in the lower part of the formation. The injection zone is composed of lenticular calcareous sandstones interbedded with low permeable carbonates and calcareous shales. The lenticular sandstones vary in thickness from 1 to 30 feet.

Confining Zone – The overall confining strata above the injection zone consists of impermeable Green River calcareous shales and continuous beds of microcrystalline dolostone. The confining zone in the Ute Tribal 36-08-E4 is 225 feet thick.

Attachment No. 3 is a structure map of the A-Marker surface.

Attachment No. 4 is a cross-section of the injection interval and confining zone.

- (6) Enclosed as Attachment No. 5 are standard analyses of produced water from three batteries that currently serve as central handling facilities for all project producing wells. The analysis of the Green River formation water from the Ute Tribal 18-08 Satellite Battery is 12805 mg/L of total dissolved solids (TDS), Ute Tribal 21-11 Satellite Battery is 15659 mg/L TDS, and Ute Tribal 34-12-D3 Satellite Battery is 14590 mg/L TDS.

Injectate in the field is a mixture of produced water and fresh make-up water. The nearest injection well is the Ute Tribal 19-13, the most recent analysis of the water being injected into the Green River formation at this location is 7342 mg/L TDS. This analysis is also included in Attachment No. 5.

- (7) A summary of completion data from the Ute Tribal 36-08-E4 and offset wells in the AOR are included in Attachment No. 6
- (8) The cement bond log is included in Attachment No. 7.
- (9) The open hole log for the Ute Tribal 36-08-E4 is included in Attachment No. 8.

(10) The Antelope Creek Field is operated under a Cooperative Plan of Development between the Ute Tribe and Petroglyph Energy. At the Ute Tribal 36-08-E4 location, all mineral owners, surface owners and operators located within the AOR ¼ mile radius have been notified of the submitted EPA application to convert to injection. Attachment No. 9 is the Affidavit of Notification to all owners.

(11) Petroglyph requests a maximum surface injection pressure of **1886psi**. The EPA Area Permit No. UT20736-00000 uses the formula:

$$P_m = (0.88\text{psi/ft} - 0.43\text{psi/ft}(S_g)) D$$

Where:

P_m = Maximum surface injection pressure

0.88psi/ft = Fracture gradient

D = Top perforation depth

0.43psi/ft = Hydrostatic pressure/hydraulic head

S_g = Specific gravity of injection fluid

For the Ute Tribal 36-08-E4:

$$\mathbf{1886psi = (0.88psi/ft - 0.43(1.00)) 4191ft}$$

(12) Three wellbore diagrams for the Ute Tribal 36-08-E4 are in Attachment No. 10. One diagram is for production, one for injection, and one for Plug & Abandonment (P&A).

(13) The P&A procedure for this well is shown in Attachment No. 11.

(14) Once the draft permit is issued, Petroglyph will conduct a Mechanical Integrity Test and a static bottom-hole pressure test. The MIT procedure is contained in Attachment No. 12. The conversion work will be satisfactorily completed and submitted to the EPA on Form 7520-12. A wellbore schematic will be included with this form.

- (15) Petroglyph will give proof of financial responsibility by posting a surety bond for the UIC well prior to final permit approval. A copy of this letter is contained in Attachment No. 13.
- (16) Petroglyph will install various gauges on the well so that the injection pressure and tubing/casing annulus pressure can be monitored. The well will be equipped with a flow meter with a cumulative volume recorder.

Ute Tribal 36-08-E4 Well History

Well History:

Spud Well: 6/1/1998

Completed: 9/11/1998

First Production: 9/11/1998

Tops (KB):

BMSW* Found at 1382'

Green River 1072'

A Marker 3534'

X Marker 4007'

Douglas Creek 4142'

B Limestone 4518'

Castle Peak 5014'

Basal Carbonate 5499'

Perf History

9/8/1998

C05	4194' to 4198'
C05.2	4244' to 4248'
C09.2	4464' to 4470'
E01.1	5086' to 5090'
E01.1	5098' to 5102'
F3	5568' to 5572'
H02	5710' to 5714'

3/7/2012

C05	4191' to 4194'	D05	4687' to 4691'
C05.2	4238' to 4244'	D7	4735' to 4738'
C05.2	4248' to 4254'	D7	4737' to 4739'
C08.1	4392' to 4399'	D7	4740' to 4744'
C09.2	4462' to 4464'	E01.1	5083' to 5086'
C09.2	4470' to 4474'	E01.1	5090' to 5098'
D05	4677' to 4679'	E01.1	5102' to 5112'

Petroglyph Operating Co., Inc.

Ute Tribal #36-08-E4

(713' FEL & 196' FNL)

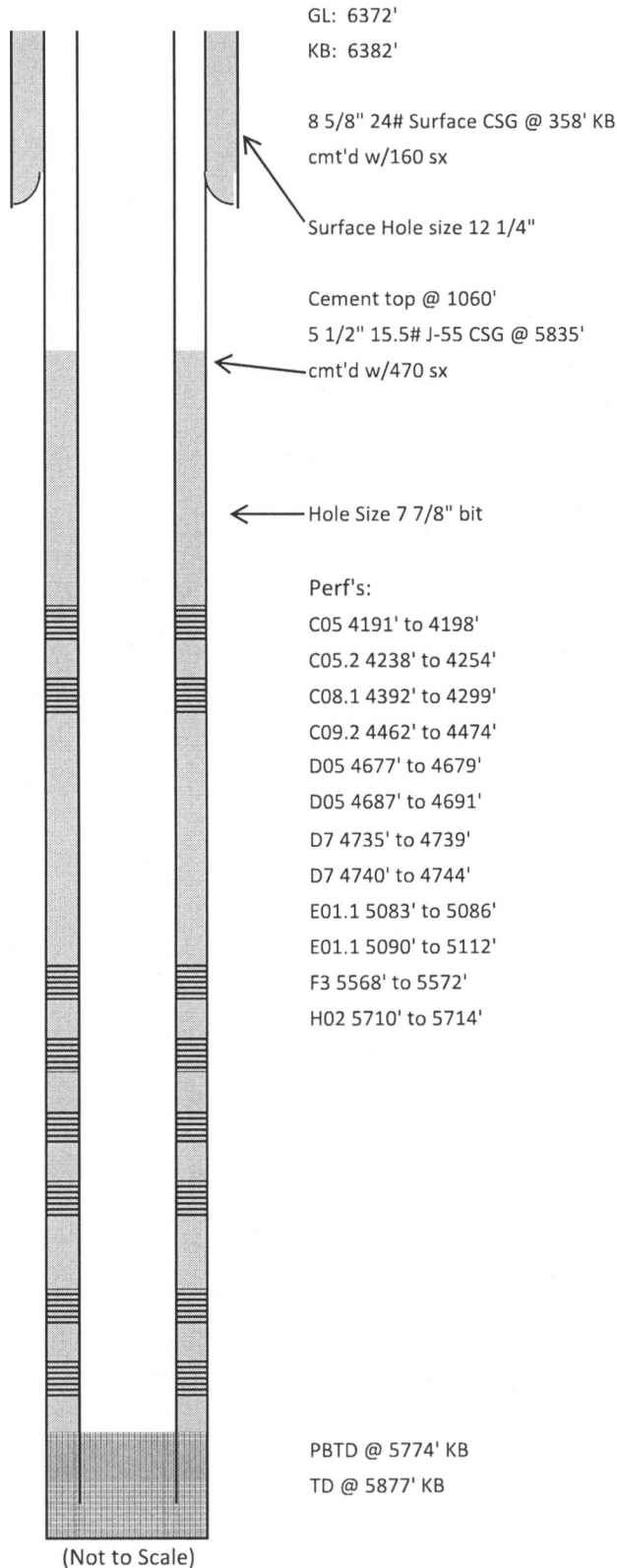
SE NE Section 36, 4S-5W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013318150000

*Plate 1 Utah Geological Survey Special Study 144.
(2012). BMSW Elevation Contour Map, Uinta Basin,
Utah. [map]. (CA 1:200,000)



Ute Tribal 36-08-E4 Injection

Well History:

Spud Well: 6/1/1998
 Completed: 9/11/1998
 First Production: 9/11/1998

Tops (KB):

BMSW* Found at 1382'

Green River 1072'

A Marker 3534'

X Marker 4007'

Douglas Creek 4142'

B Limestone 4518'

Castle Peak 5014'

Basal Carbonate 5499'

Injection packer @ 4101'

Set BP @ 5498'

Petroglyph Operating Co., Inc.

Ute Tribal #36-08-E4

(713' FEL & 196' FNL)

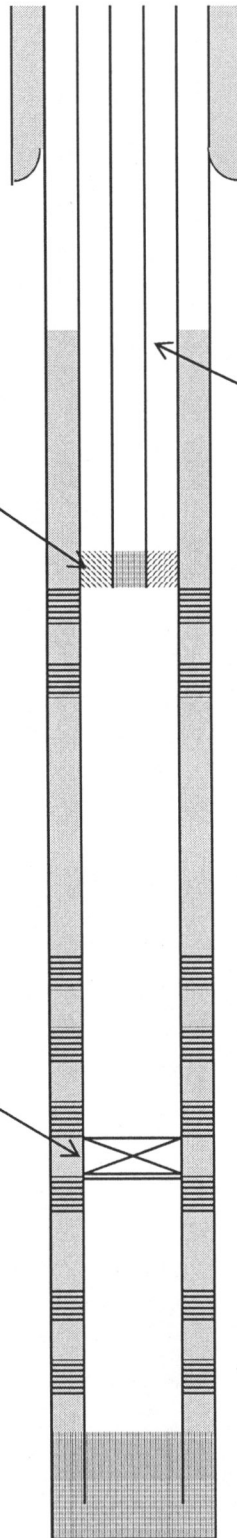
SE NE Section 36, 4S-5W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013318150000

*Plate 1 Utah Geological Survey Special Study 144. (2012).
 BMSW Elevation Contour Map, Uinta Basin, Utah. [map]. (CA
 1:200,000)



GL: 6372'

KB: 6382'

8 5/8" 24# Surface CSG @ 358' KB

cmt'd w/160 sx

Surface Hole size 12 1/4"

Cement top @ 1060'

5 1/2" 15.5# J-55 CSG @ 5835'

cmt'd w/470 sx

Tubing 2 7/8" 6.5# J55

Hole Size 7 7/8" bit

Perf's:

C05 4191' to 4198'

C05.2 4238' to 4254'

C08.1 4392' to 4299'

C09.2 4462' to 4474'

D05 4677' to 4679'

D05 4687' to 4691'

D7 4735' to 4739'

D7 4740' to 4744'

E01.1 5083' to 5086'

E01.1 5090' to 5112'

F3 5568' to 5572'

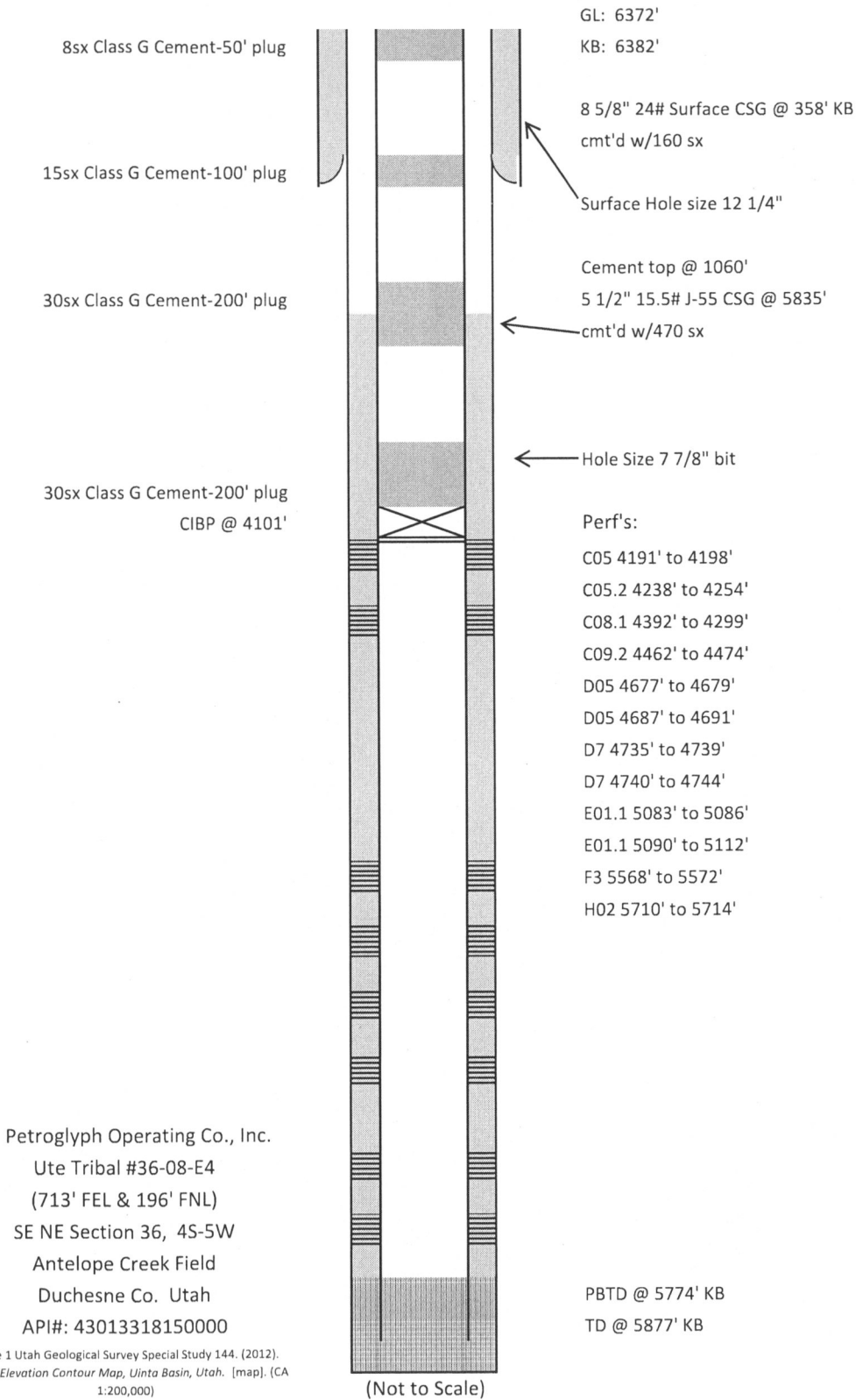
H02 5710' to 5714'

PBTD @ 5774' KB

TD @ 5877' KB

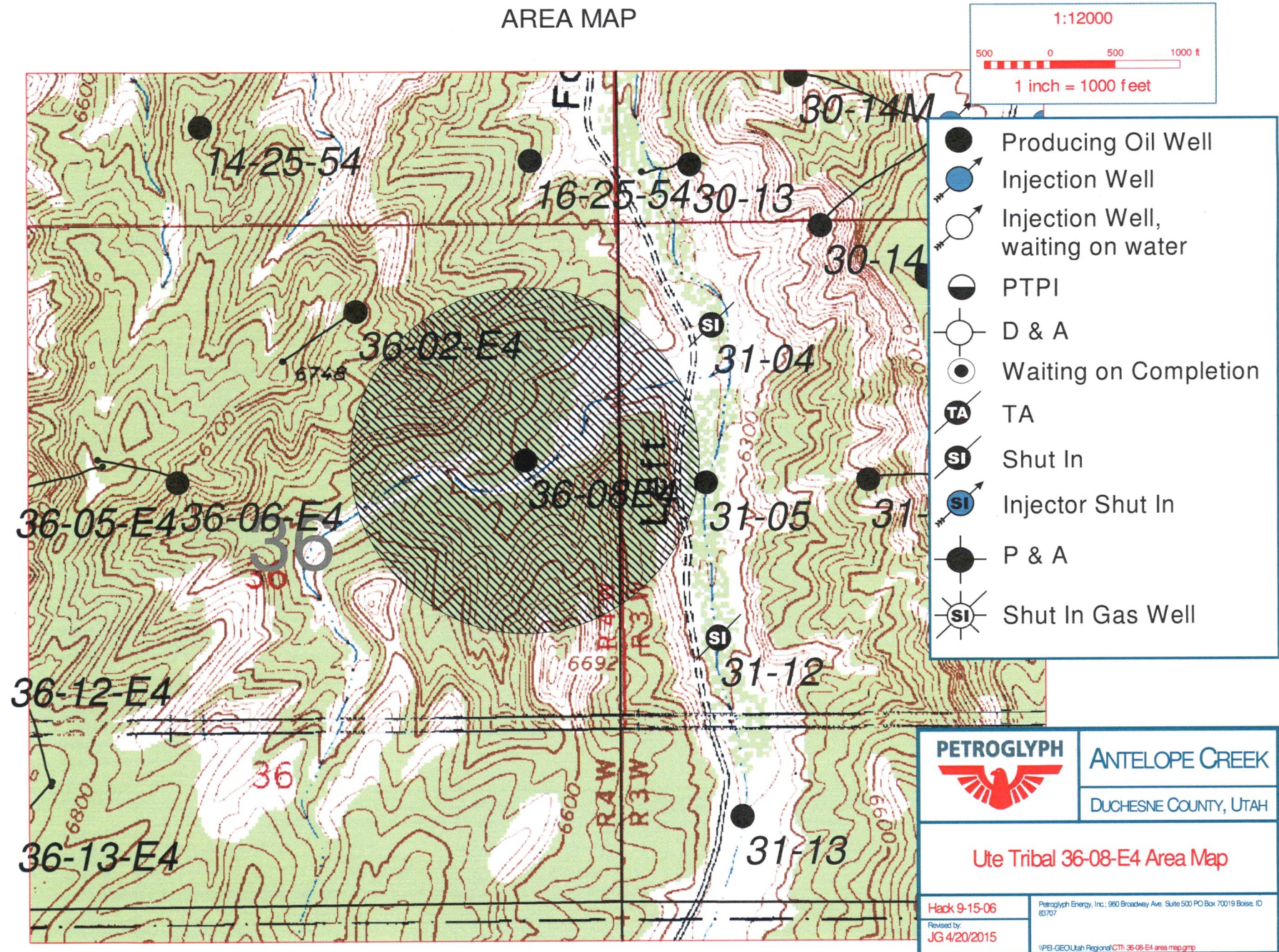
(Not to Scale)

Ute Tribal 36-08-E4 Plug and Abandonment



*Plate 1 Utah Geological Survey Special Study 144. (2012).
BMSW Elevation Contour Map, Uinta Basin, Utah. [map]. (CA
1:200,000)

ATTACHMENT NO. 1: AREA MAP



1 inch = 2500 feet

- | | |
|--|----------------------------------|
| | Producing Oil Well |
| | Injection Well |
| | Injection Well, waiting on water |
| | PTPI |
| | D & A |
| | Waiting on Completion |
| | TA |
| | Shut In |
| | Injector Shut In |
| | P & A |
| | Shut In Gas Well |



DUCESNE COUNTY, UTAH

Structure Map of the "A" Lime Marker
(approximate top of Injection Zone)
in the Vicinity of the
Ute Tribal 36-08-E4
With Line of Cross Section A to A'

hack 7-11-06

Revised by:
JG 4/20/15

Petroglyph Energy, Inc., 555 S. Cole Rd., Boise, ID 83709

\\SERV\Geo\Utah Regional\CTI\36-06-E4 structure map.gm

Cement Bond Index (in millivolts - mV)

Date: September 2, 2015

Operator: Petroglyph

Well: Ute Tribal 36-08-E4

Permit: _____

Enter the following values:

Amplitude at 0% Bond (A-0) (in mV) = 60 mV

Amplitude at 100% Bond (A-100) (in mV) = 1 mV

Amplitude at 80% Bond (A-80) = 2.3 mV

$[(0.2)\log A0 + (0.8)\log A100]$

80% Bond
OK

Amplitude at 90% Bond (A-90) = 1.5 mV

$[(0.1)\log A0 + (0.9)\log A100]$

Amplitude at 70% Bond (A-70) = 3.4 mV

$[(0.3)\log A0 + (0.7)\log A100]$

Amplitude at 60% Bond (A-60) = 5.1 mV

$[(0.4)\log A0 + (0.6)\log A100]$

Maximum Allowable Injection Pressure (MAIP)
From Fracture Gradient

Date: 09/02/2015 Operator: Petroglyph
Well: Ute Tribal 36-08-E4
Permit #: _____

Enter the following values:

Specific Gravity of injectate =	<u>1.010</u>	g/cc
Depth to top of injection interval =	<u>3,534</u>	feet
Fracture Gradient (F G) =	<u>0.880</u>	psi/ft

MAIP = **1,560** psig

(rounded down to nearest 5 psig)

where:

$$MSIP = [FG - (0.433 * SG)] * \text{Depth to top of injection interval} = 1564.396$$

NEW AREA PERMIT ADDITION

~~Newfield Production~~

Technical Review Worksheet

Permit No: UT2

Well: UT 36-08-E4

What Needs to be Done	Information Sources	Review & Evaluation Notes
Determine name, top and base of the confining zone(s) and the injection zone(s).	<input type="checkbox"/> Geologic data submitted <input type="checkbox"/> Well logs from area <input type="checkbox"/> Published articles	Conf Zone: top <u>3308</u> base <u>3534</u> Inj Zone: top <u>3534</u> base <u>5499</u> (Garden Gulch 2-Marker) (top Wasatch)
Determine name, top and base of all USDWs. List base of lowermost USDW: Determine which USDWs are actually being used for water supply.	<input type="checkbox"/> Geologic data submitted <input type="checkbox"/> nearby Water analyses <input type="checkbox"/> nearby Well logs <input type="checkbox"/> Water supply wells <input type="checkbox"/> Published articles	Surface Elevation: <u>GL 6372 KB: 6382</u> Pub #92 base USDW: bgs: elev: submitted base USDW bgs: <u>1382</u> elev: base of Uinta / top Green River: <u>1072</u> USDW in GR
Review and evaluate construction, casing and cementing records of proposed well. Review and evaluate construction, casing and cementing records of AOR wells that penetrate injection zone.	<input type="checkbox"/> Data submitted <input type="checkbox"/> Completion/workover reports <input type="checkbox"/> Contractor invoices <input type="checkbox"/> Logs: CBL, RTS, Temp, casing inspection, etc. <div style="text-align: center; font-size: 1.5em; transform: rotate(-15deg);"> 60/1 2.3-80% 80% OK </div>	TD: <u>5877</u> PBTD: <u>5774</u> surface csg <u>8 5/8" 24#</u> ft <u>0-358</u> s: long strg csg <u>5 1/2" 15.5#</u> ft <u>0-5835</u> s: TOC: submitted: <u>1060</u> CBL: <u>1120</u> Wells in AOR: TD TOC C <u>31-05 ?</u>
Review P&A plan for effective USDW protection, injection zone isolation and well closure.	<input type="checkbox"/> P&A plan <input type="checkbox"/> Area geology	plug depths:
Review amount of FR - is it adequate to cover P&A costs of proposed in P&A plan?	<input type="checkbox"/> contractor bids / P&A cost histories <input type="checkbox"/> nearby well P&A costs	FR instrument: Amount: \$
Calculate the maximum allowable injection pressure (MAIP).	<input type="checkbox"/> Fracture treatments <input type="checkbox"/> Step Rate Test results <input type="checkbox"/> Fracture gradient	top perforation: <u>4191</u> bottom perforation: <u>5714</u> injectate specific gravity: <u>1.01</u> Frac Gradient: <u>.88</u> p: initial MAIP = _____ psi
Determine which logs and tests will be performed.		

Structural Cross Section in the Vicinity of Ute Tribal 36-08-E4

